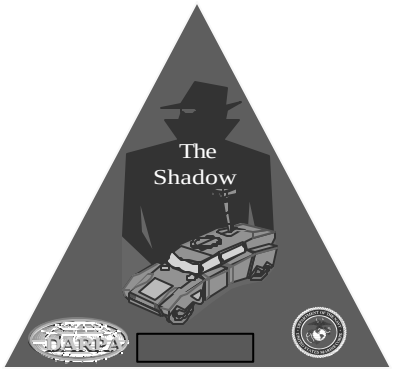
RECONNAISSANCE, SURVEILLANCE AND TARGETING VEHICLE (RST-V)

NDIA Expeditionary Warfare Conference

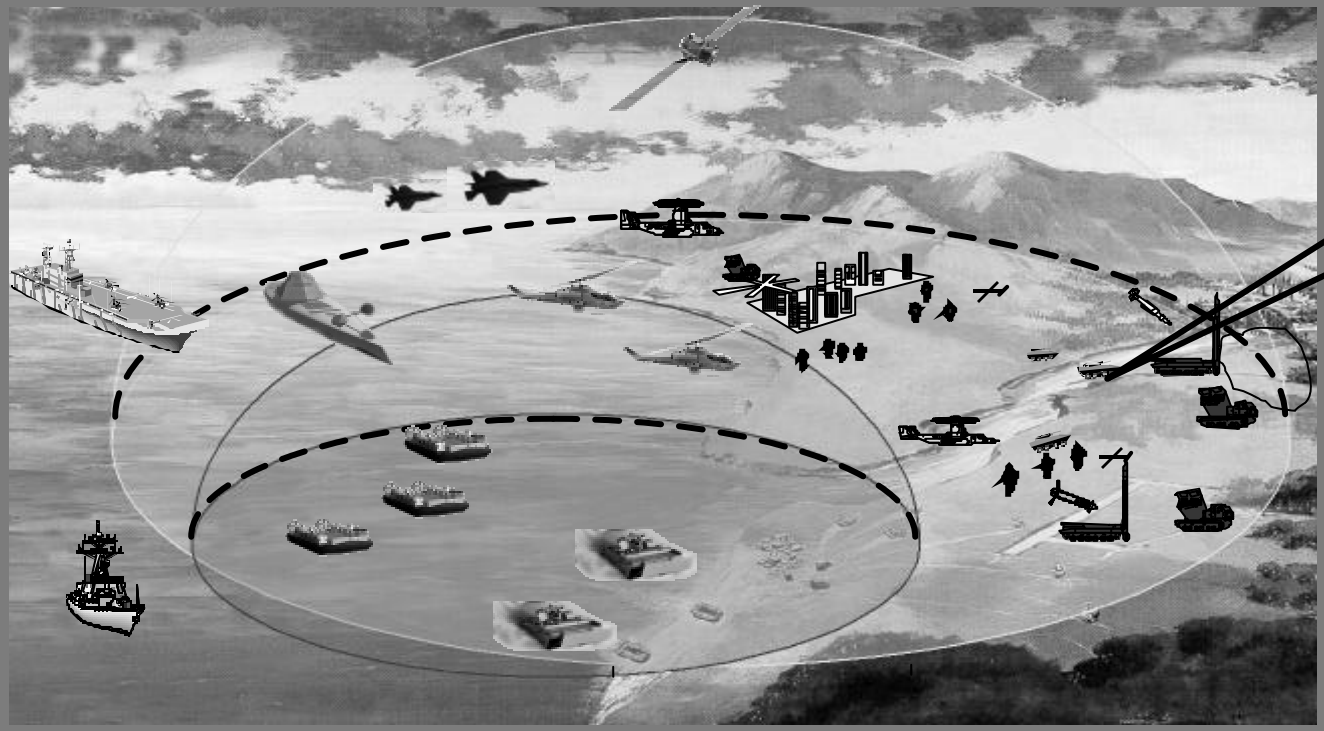
October 23-26, 2000



Colonel Joseph Kennedy
Deputy Program Manager
Defense Advanced Research Projects Agency

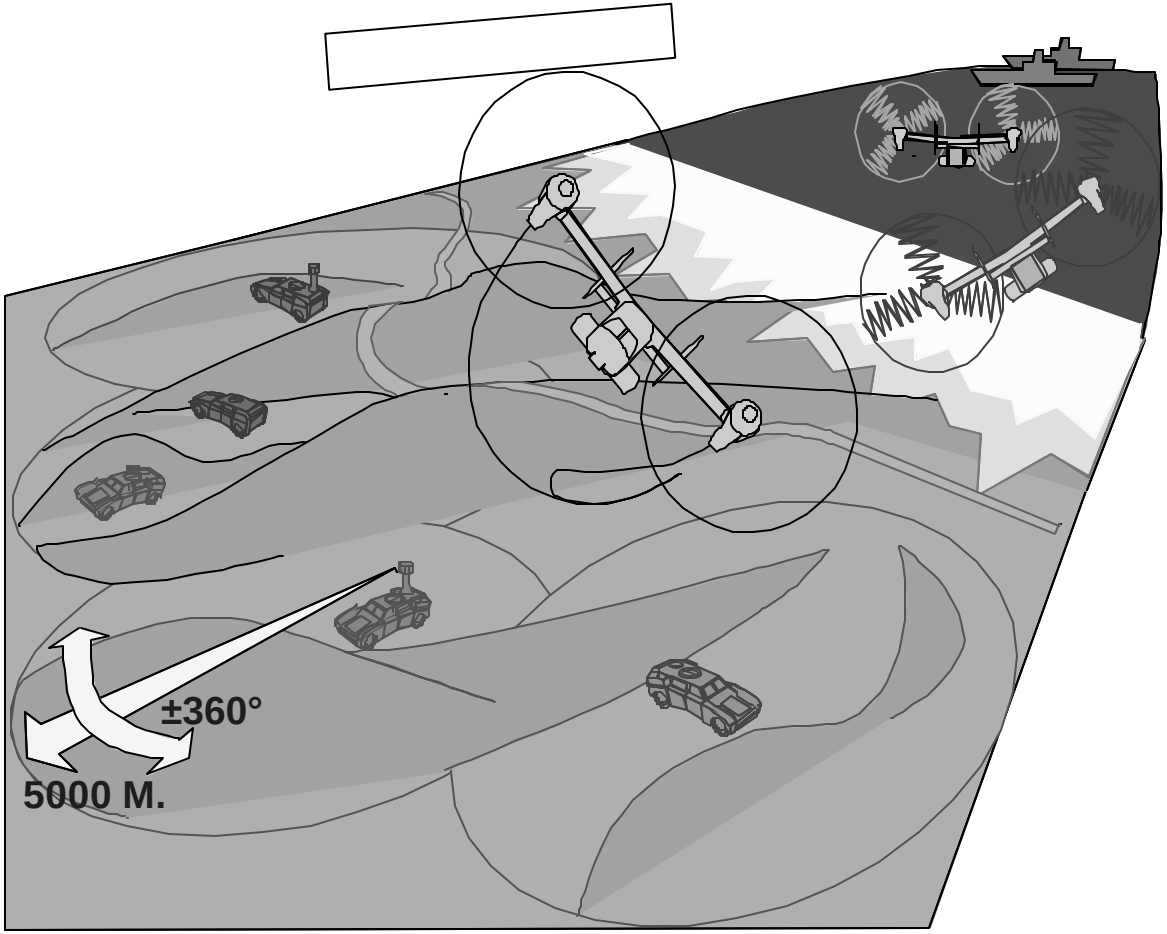
MR. JEFFREY BRADEL
Technical Lead
Office of Naval Research

Decisive Power From The Sea



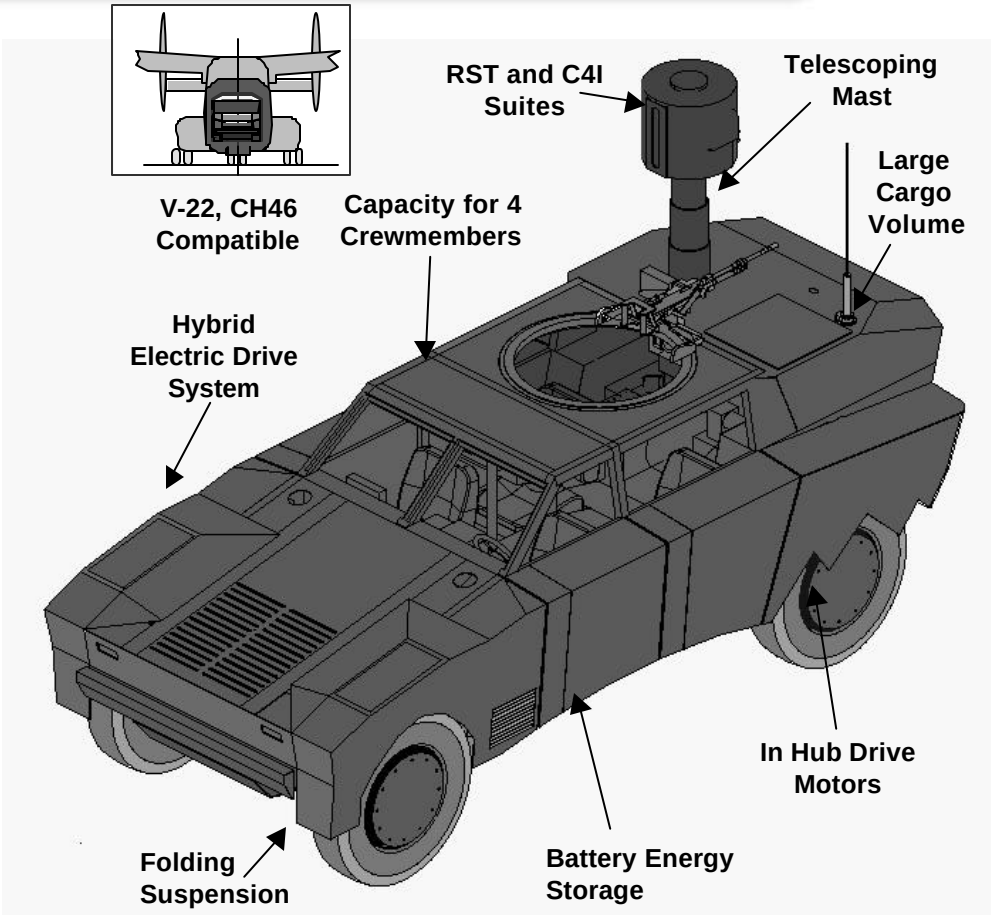
SYSTEM CONCEPT

- **V-22 Internal Transport**
  - Deployment Ready
  - Tactical and Deep Insertion
  - 10 Day Mission
- **Integrated Survivability**
  - Ballistic
  - AP Mine
  - Managed Signature
- **Hybrid Electric Drive**
  - Improved Fuel Economy
  - Improved Range
  - Extended Silent Watch
  - Silent Movement



KEY RST-V FEATURES

- **GDLS RST-V Design Meets Operational and Demonstration Objectives:**
  - **Increased All Terrain Mobility, Agility, Acceleration**
  - **Improved Fuel Economy and Range**
  - **Silent Watch and Auxiliary Power Capability**
  - **Payload Same as HMMWV**
- **Solves V-22 Vehicle Width vs. Lateral Stability Problem**
- **Realizes Full Potential of Hybrid Electric Drive**
- **High Future Growth Potential**



Designed for High Payoff in Military Utility *with* Growth Potential

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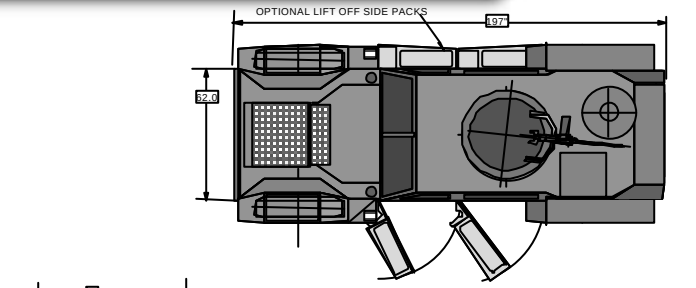
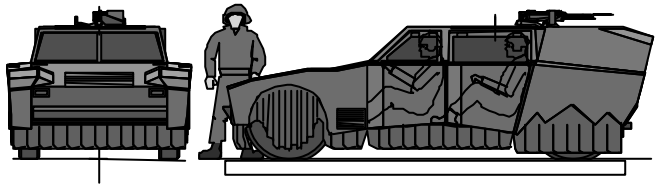
RST-V PERFORMANCE

CHARACTERISTICS	RST-V	HMMWV (M1025A2)
Gross Vehicle Weight	8000* lb.	10300lb.
Payload	**3000 lb.**	3520lb.
Air Transport - Internal roll on/roll off	**V-22,CH53,C-130**	C-130
Range - Engine (25 gals fuel) highway, 30 mph	**450 mi.**	270 mi.
Range - Batteries (Highway)	**21 mi.**	na
Relative Fuel Economy (scenario dependent)	**1.7-2.0 X**	Reference
Fording Depth	36 in.	36 in.
Gradeability /Side Slope	60%/40 %	60%/40%
Top Speed Hwy.	70+ mph	70 mph
Ride-limited speed, rough cross country	**~18 mph**	~12 mph
0-30 mph Acceleration	**~3.0 sec.**	9.4 sec.
0-60 mph Accel. (HMMWV 0-50 mph)	**15 sec.**	25+ sec.
VCI - off road (25% deflection)	**19.8**	20.2
Ground Clearance	**4 - 24 in. (variable)**	16 in.
Amphibious option	**Adaptable**	no

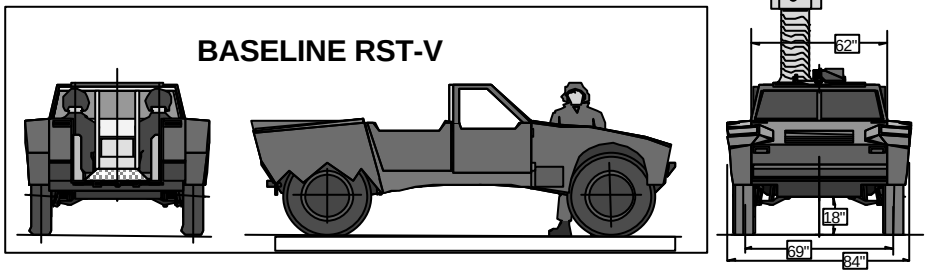


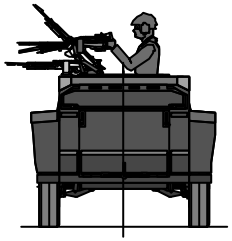
V-22 TRANSPORT PROFILE

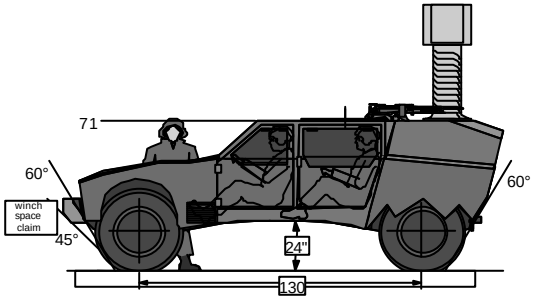


RECON MODE

BASELINE RST-V







CROSS COUNTRY

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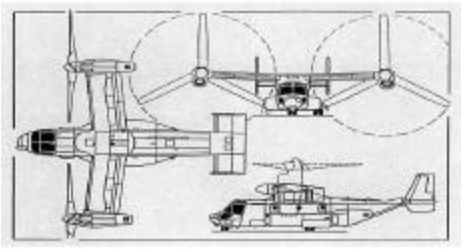
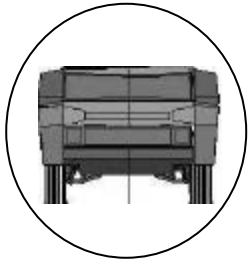
RST-V Transportability



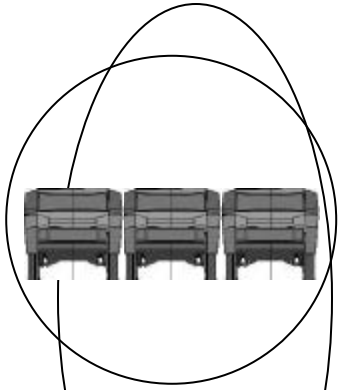
V-22 OSPREY

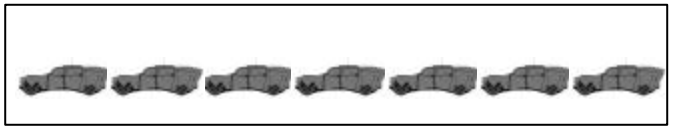


Capacity: RST-V: 1
HMMWV: 0

LENGTH:20 FT 8 IN.
WIDTH: 5 FT. 8 IN.
HEIGHT:5 FT. 6 IN.
VOLUME:858 CU. FT.
PAYLOAD: 20,000 LB.

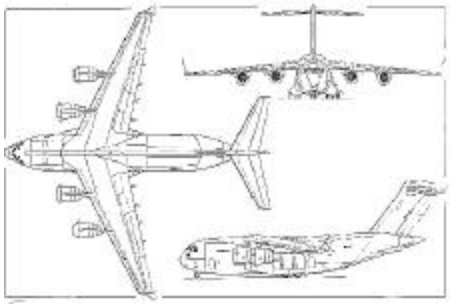
C-5 GALAXY



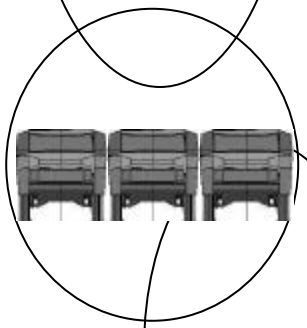


Capacity: RST-V: 21
HMMWV: 15

LENGTH:121 FT 1 IN.
WIDTH: 19 FT. 0 IN.
HEIGHT:13 FT. 5 IN.
VOLUME:34,795 CU. FT.
PAYLOAD: 261,000 LB.



C-17 GLOBEMASTER



Capacity: RST-V: 12
HMMWV: 8

LENGTH:68 FT 2 IN.
WIDTH: 18 FT. 0 IN.
HEIGHT:12 FT. 4 IN.
VOLUME:20,900 CU. FT.
PAYLOAD: 170,400 LB.

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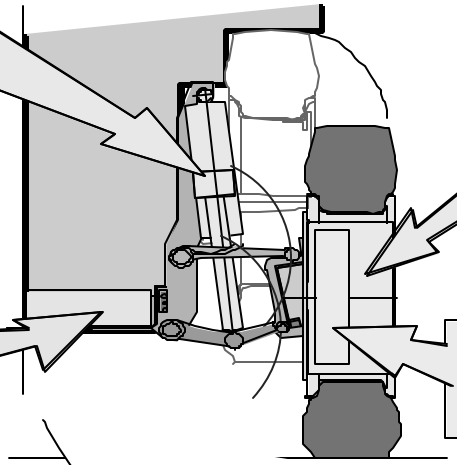
KEY ENABLING TECHNOLOGIES

PNEUMATIC SYSTEM + FOLDING SUSPENSION *

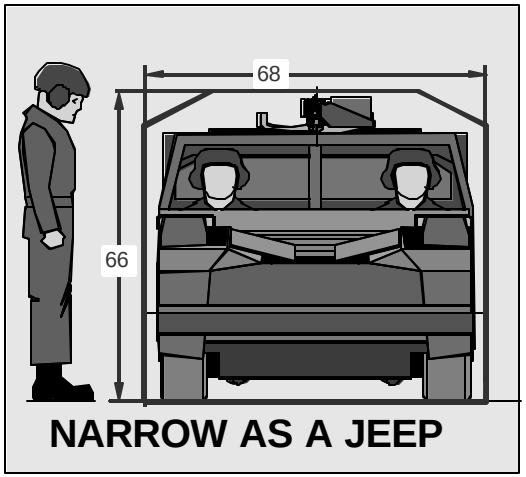
*** Patent Applied For**



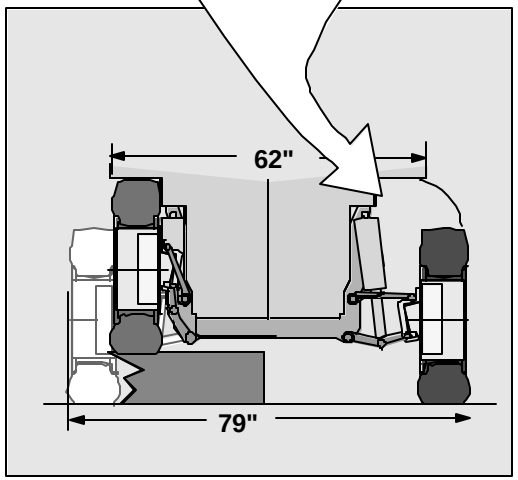
IN-HUB DRIVE

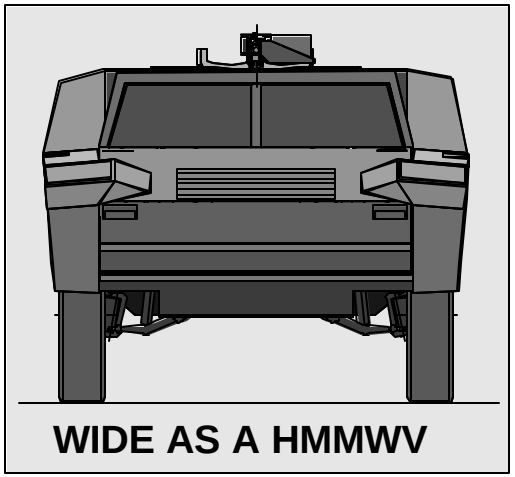
HIGH ENERGY DENSITY BATTERIES

PERMANENT MAGNET MOTORS



NARROW AS A JEEP





WIDE AS A HMMWV

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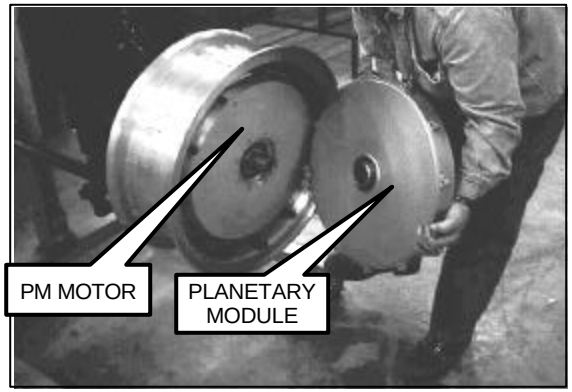
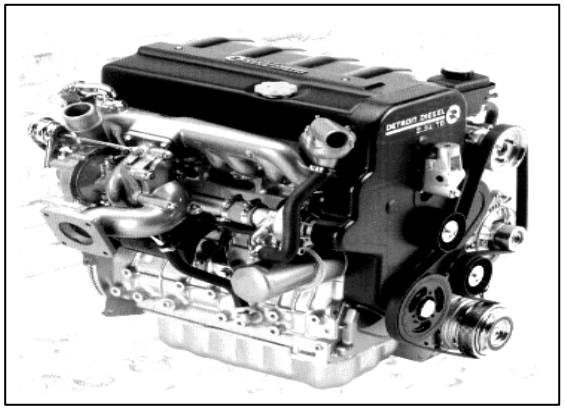
KEY SUBSYSTEMS

Wheel Drive Unit

- MM Permanent Magnet Motor
- Modular Design
- Push Start With Dead Batteries
- Torque 3660 Nm (Peak) 3030 Nm (Continuous)





IC Engine

- DDC TD DI-4V, 2.5 liter, 114 kW
- Common Rail Direct Injection Diesel
- Turbocharged, Intercooled
- Meets EURO 3 Emissions Requirements
- 207 gr/kW hr. BSFC

Energy Storage

- Saft Lithium-Ion Battery Technology
- EV Optimized Battery Chosen for Application
- 2 Packs, 240 V, 10 kWh Each
- Burst Power 90 kW

OPERATING MODES

Normal

- **Hybrid Drive Powered by Generator and HV Battery**

Recon

- **Powered by HV Battery, OR**
- **Powered by HV Battery and Engine, With Engine Running at an Optimum Power Level**

Fuel Economy

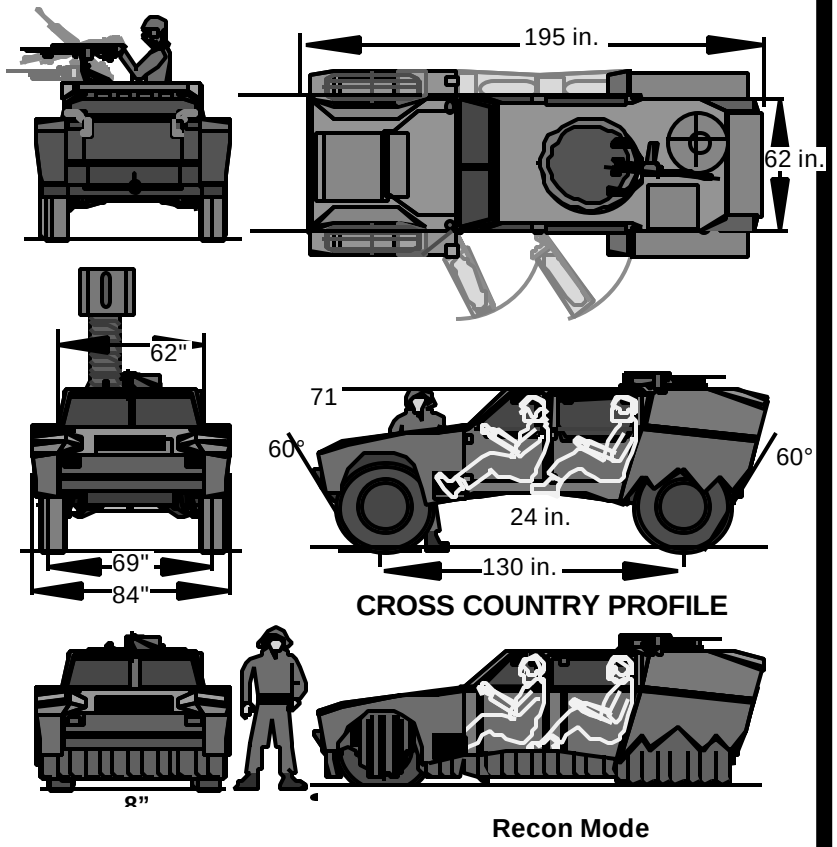
- **Power Limited to Optimum Fuel Economy Power Level**

Silent Watch

- **No Mobility**
- **Minimum Power Consumption**
- **Power Supplied by HV Battery**
- **Charging Available by Operator Command**

Auxiliary Power

- **Stabilizes The DC Link at 480V, ~85 kW, Assumes External Power Conditioning**

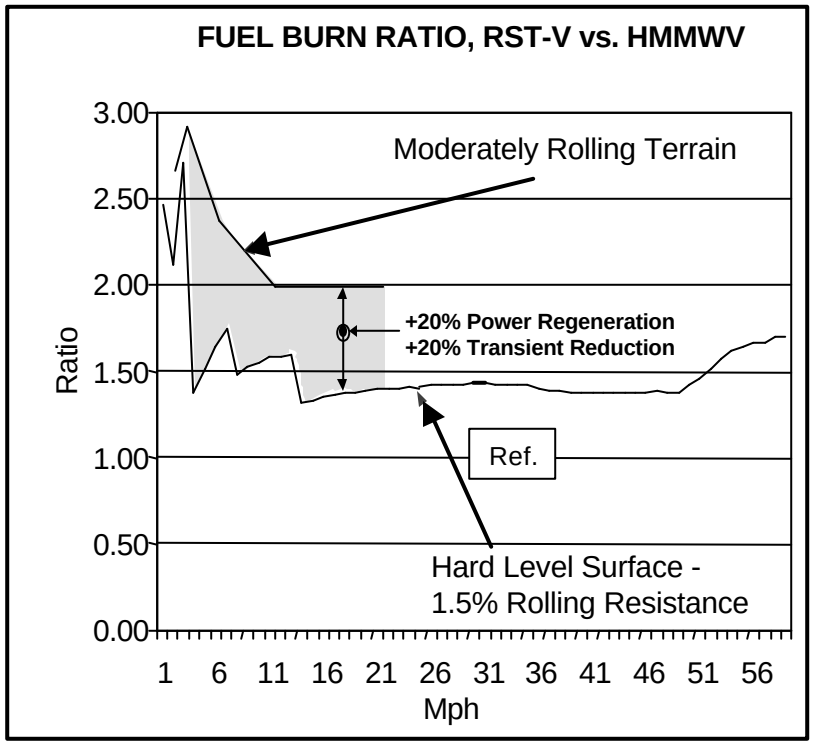


CROSS COUNTRY PROFILE

Recon Mode

HYBRID ELECTRIC DRIVE PAYOFFS

- **Improved Fuel Economy**
  - **Energy Storage**
  - **Power Regeneration**
  - **Optimum Engine Operation**
- **Burst Power (~2 Times Base Engine)**
- **Extended Silent Watch (>20 Hours)**
- **Battery-Only Operation (~21 Miles)**
- **Redundant Power (Engine or Batteries)**
- **Abundant Aux. Power, No APU Needed**
- **Remote Control Option**
- **With In-Hub Wheel Drive:**
  - **4x Drive Train Redundancy**
  - **Maximum All-Terrain Traction**
  - **Fail-Safe Torque Limiting**
- **Lowered Engine Stress and O&S Burdens**



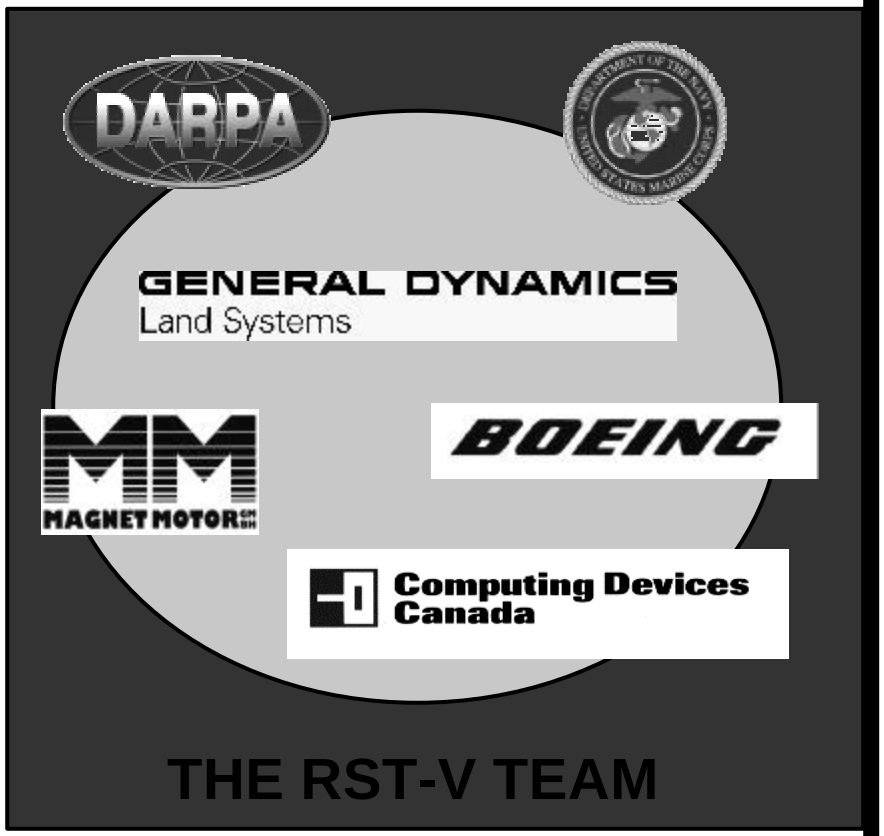
RST-V Fuel Efficiency Consistently Exceeds HMMWV By 1.4x, And Up To >2.5x (At Low Speeds)

FUEL ECONOMY + REDUNDANCY + BURST POWER = A GIANT LEAP AHEAD FOR FORCES IN HOSTILE TERRITORY WITH LIMITED SUPPORT

7/26/00

PROGRAM SUMMARY

- **Sponsors**
  - DARPA and USMC (Through ONR and NSWC-Carderock Div.)
- **Period Of Performance:**
  - January 1999-April 2002
- **Objective**
  - Design, Build, Demonstrate and Evaluate Advanced RST Vehicle with
    - ➢V-22 Compatibility
    - ➢Hybrid Electric Drive
    - ➢Integral Adv. Survivability
    - ➢Performance ≥ HMMWV
- **Major Deliverables**
  - 2 Demonstrator Vehicles
  - 2 Baseline Vehicles
  - Test Support, Spare Parts
  - Design Documentation, Data



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